1.0 TITLE OF EFFORT: System Analysis & Integration

2.0 TASK DESCRIPTION:

The contractor shall perform the tasks below in accomplishing ISS systems analysis and integration. The contractor shall use the coordinate systems defined in SSP 30219, ISS Reference Coordinate Systems Document, for analysis, products, or data that is produced for ISSP and requires the use of coordinate systems.

2.1 STATEMENT OF WORK REFERENCE: Section 2.0 – Systems Engineering, Analysis and Integration

2.2 REQUIREMENTS, DELIVERABLES, SCHEDULE:

	Performance Requirement	Workload Indicators	Quantity	Schedule
2	SYSTEM ENGINEERING, ANALYSIS, AND INTEGRATION			
2.1	RESERVED			
2.2	System Analysis and Integration			
2.2.1	Program Requirements and Interfaces			
2.2.1.1	ISS Specifications and ICDs Maintenance			
2.2.1.1.a	Provide book coordination functions for ISS Specifications, Interface Control Documents (ICDs), and Interface Requirements Documents (IRDs)	Updates to Specs, IRDs, ICDs	See Appendix H - revised	See DRD
2.2.1.1.b	Maintain the contents of the Master File for all Specifications and ICDs/Interface Requirements Documents (IRDs)	Update Master File	1 update	Monthly
2.2.1.1.c	Maintain tracking logs of Specifications, CRs and ICD/IRD Revisions and History	Tracking Logs	1 update	Monthly
2.2.1.1.d	Maintain, update and produce Requirements Traceability and Management (RTM) Reports	RTM reports	See DRD	See DRD
2.2.1.1.e	Identify and track non-incorporated CRs to all retired, or no longer actively maintained, ISS specifications and ICDs	Identification and tracking of non-incorporated CRs	4 CRs	Weekly
2.2.1.1.f	Review all program CRs to assess impacts to supported	CR Evaluations	15 CRs	Weekly

	documents.			
2.2.1.2	Coordination and review of ISS Specifications and ICDs			
2.2.1.2.a	Provide technical review Specifications and ICDs during Milestone Reviews	Comments to Specifications and ICDs	3 reviews at 20 comments per review.	Yearly
2.2.1.2.b	Provide technical review and coordination of Preliminary Interface Notices (PIRNs) and Document Change Notices (DCNs)	Comments to PIRNs and DCNs	60	Monthly
2.2.1.3	ICWG			
2.2.1.3.1	Maintain and update Hardware Interfaces Tracking System (HITS) Microsoft Access database			
2.2.1.3.1.a	Track and provide ICD metrics reports	ICD Metrics reports	1	Monthly
2.2.1.3.1.b	Track and provide Element Manager Open PIRNs reports	Element Manager Open PIRNs reports	8	Weekly
2.2.1.3.1.c	Track and provide reports identifying TBDs	Reports identifying TBDs	1	Monthly
2.2.1.3.1.d	Track and provide Open Issues reports	Open Issues reports	1	Monthly
2.2.1.3.2	Provide administrative support for Milestone Reviews	Administrative support for Milestone Reviews	3	Yearly
2.2.1.3.3	Prepare, distribute, maintain and track Interface Memorandums	Interface Memorandums	16	Monthly
2.2.1.3.4	PIRN and DCN Development and Maintenance			
2.2.1.3.4.a	Prepare, distribute, process, maintain, and track Preliminary Interface Revision Notices (PIRNs)	ICD PIRNs	5	Monthly
2.2.1.3.4.b	Prepare, distribute, process, maintain, and track Document Change Notices (DCNs)	IRD DCNs	3	Monthly
2.2.2	System Performance Analysis and Integration	Recommendations to ISSP management and assistance in development of strategic requirements	Twice	Monthly
2.2.2.1	Mission Analysis and Integration			
2.2.2.1.1	Attitude Requirements			
2.2.2.1.1.a	Develop, coordinate and obtain ISSP approval of the flight attitude requirements for the ISS	Flight attitude requirements	Nine	Yearly

	operations			
2.2.2.1.1.b	Input and maintain approved attitude requirements in the Space Station Certification Baseline Document (SSP 50699-03)	Flight attitude requirements updates in Cert Baseline (SSP 50699-03)	Once	Yearly
2.2.2.1.2	Develop and coordinate the ISS altitude strategy	1. Altitude strategy assessment 2. Update Altitude Strategy in OSD 3. Provide inputs to Mission Integration team 4. VAC Statement Preparation	1. Once 2. Once 3. 1 per Increment 4. 1 per Flight	1. Quarterly 2. Annually 3. Increment-18 months 4. L-2 months
2.2.2.1.3	Integrate rendezvous, proximity, and other special operations requirements and constraints related to attitudes and system configurations for joint operations between the ISS and all ISS Visiting Vehicles	1. Requirements and constraints for joint operations between ISS and all ISS Visiting Vehicles 2. Development of the Space Shuttle/ISS Proximity Operations Timelines 3. Baseplate deliveries	1. 1-2 design reviews and 75 biweekly teleconferences 2. 1 per Flight 3. Once	1. Yearly 2. L-5 months 3. Monthly
2.2.2.1.3.1	Integrate rendezvous, proximity, and other special operations requirements and constraints related to attitudes and system configurations for joint operations between the ISS and the Crew Exploration Vehicle (CEV)	Requirements and constraints development for joint operations between ISS and CEV	4 assessments/major reviews	Yearly
2.2.2.1.3.2	Integrate rendezvous, proximity, and other special operations requirements and constraints related to attitudes and system configurations for joint operations between the ISS and the Commercial Orbital Transfer Services (COTS) vehicles.	Requirements and constraints development for joint operations between ISS and COTS.	8 assessments/major reviews	Yearly
2.2.2.1.3.3	Comply with US requirements for information security to assess analyses analysis and data incorporating the classified capabilities of the US national technical means, whever necessary to complete the assigned special operations assessments.	Assessments/meeting support requiring such information security, which includes but are not limited to, planning, analysis, and scientific observation of the end-ot-life de-orbit of the ISS.	Once	Monthly

2.2.2.1.4	Provide predictions for the ISS solar beta angle	Predictions for ISS solar beta angle	Once	Quarterly
2.2.2.1.5	Develop, track, and maintain the strategic allocation of Vehicle technical resources	Strategic allocation of Vehicle technical resources	Once	Quarterly
2.2.2.1.5.1	Coordinate projected water delivery and usage rates with ISSP suppliers and users of water	Projections for water delivery and usage rates	Once per increment	Increment -18 months
2.2.2.1.6	Applications and Data Systems	Updates to applications and data systems	1 update for each of 4 applications and data systems.	Yearly
2.2.2.2	Mission Requirements and Support			
2.2.2.2.1	Provide strategic mission requirements, concepts, constraints, and resource allocations to the ISS Mission Integration team and NASA Mission Operations Directorate (MOD) to support development of mission planning, flight rules, and training	Strategic mission requirements, concepts, constraints, and resource allocations to Mission Integration Team and MOD	One initial delivery per Shuttle flight One update per Shuttle flight at Flight Operations Review	Launch - 18 months Launch - 6 months
2.2.2.2.2	Review of Operations Products			
2.2.2.2.2.a	Review the ISS operations plans and procedures to ensure that all ISSP strategic technical constraints are satisfied	Comments to ISS operations plan and procedures	Once per Shuttle flight at FOR	Launch - 6 months
2.2.2.2.2.b	Review crew procedures that are related to systems activation or rechannelization, or to environment interactions to ensure that all strategic technical constraints are satisfied	Comments to crew procedures	Once per Shuttle flight at FOR	Launch - 6 months
2.2.2.2.2.c	Flight Rule Change Request (CR) coordination, technical reviews, and tracking for OM3	1. Review ISS Program Flight Rule CRs, assign and perform technical reviews. 2. Provide weekly CR tracking to VIPER Working Group	1. 100 Flight Rule CR reviews 2. Once	1. Monthly 2. Weekly
2.2.2.2.3	Report to ISSP Management the closure of the ISS Stage Integration Reviwes (SIRs) as defined in SSP 50200-1.	Close SIR issues as a result of formal review of assembly and operations plans for each flight and all pertinent ICDs. Provide	Once	Weekly

		weekly status reports to ISSP Management		
2.2.2.2.4	Provide technical support as needed to Mission Operations Directorate and to the ISSP through assessment of strategic ISS impacts during resolution of significant in-flight anomalies	Assessments of strategic ISS impacts resulting from anomalies	7 anomalies	Yearly
2.2.2.3	Provide overall system analysis and integration of the ISS and associated interfaces			
2.2.2.3.1	Integrate ISS operational procedures and hardware thermal performance data to ensure component survivability from launch to its activation on the ISS	LTA Analysis, which is a thermal assessment of assembly, deployment timeline and assumptions for external hardware in Shuttle Payload bay that is deployed on ISS (complexity and scope varies per flight)	One per Shuttle flight	Launch - 6 months
2.2.2.3.2	Provide recommendations to ISSP management in the development and prioritization of tasks performed by NASA institutional resources for the Shuttle/ISS Induced Loads and Plume Heating analyses	1. Recommendations regarding Shuttle/ISS Induced Loads 2. Recommendations regarding Plume Heating analyses	1. 1-2 recommendations 2. 1-2 recommendations	1. Yearly 2. Yearly
2.2.2.3.3	Develop and provide strategic assessments of ISS Thermal System Performance (TSP) throughout assembly phases and other significant ISS operations	Strategic assessments of ISS Thermal System Performance development.	Once per increment	Launch - 18 months
2.2.2.3.4	Develop and provide heat load allocations to the ISS end-user community, based upon active heat rejection margin analysis	Heat load allocations development.	Once per increment	Launch - 18 months
2.2.2.3.5	Develop and provide power allocations to the ISS end-user community, based upon Integrated Energy Balance margin analysis	Power allocations for IDRD development and SCEPTER Tool Maintenance.	Once per increment	Launch - 18 months
2.2.2.3.6	Provide systems integration support for assembly, off-nominal situations, and strategic operations that involve the Electrical Power Subsystem.	Provide technical support for Plasma SPRT, Solar Array Constraints WG, Bilateral Electrical WE, and VAC analysis. Perform Electrical Power	Eight	Monthly

		Subsystem special studies in support of nominal, off-nominal, and assembly situations		
2.2.2.4	ISS Program Change Request coordination, technical reviews, and tracking for OM3.	1. Review ISS program CRs, assign and perform technical reviews. 2. Provide weekly CR tracking to VIPER Working Group	1. 50 CR reviews 2. Once	1. Monthly 2. Weekly
2.2.3	Strategic Planning, Assembly & Configuration Engineering			
2.2.3.1	Strategic Planning & Integration (SPI)			
2.2.3.1.01	Develop and maintain the Integrated Flight Schedule (IFS) and Reference Assembly Sequence Overview	1. IFS 2. ASOV	1. Fourteen 2. Fourteen	1. Yearly 2. Yearly
2.2.3.1.02	Perform ISSP Crew Rotation Plan assessments	Crew Rotation Plan assessments 1. Major Study requiring more than 1 month to assess 2. Minor Study requiring less than 1 month to assess	1. Two 2. Two	1. Yearly 2. Yearly
2.2.3.1.03	Develop and maintain the SCROALE (Schedule of Crew Rotation, On-orbit Assembly, Logistics, and EVA).	1. SCROALE for the development of the MIM 2. SCROALE for the annual traffic model report.	1. One 2. One	1. Yearly 2. Yearly
2.2.3.1.04	Develop and maintain Flight Program Figure	Flight Program Figure (FPF)	Twelve	Yearly
2.2.3.1.05	Strategic Flight Plan Development	MIM (or equivalent) update	One	Yearly
2.2.3.1.06	Provide Mission Overviews for Program Mission Integration	Mission Overviews are developed to support flight	One	At L-18 months for each ISS shuttle

	Office	transition from strategic to tactical timeframes		flight mission
2.2.3.1.07	Assess proposed tactical and strategic mission updates and identify issues and/or impacts to the SFP	Strategic and tactical assessments	6	Yearly
2.2.3.1.08	Participate in the OM2 Working Group and provide the integration and coordination of strategic ISSP/SSP flight inputs to the Space Shuttle Program (SSP) & International Space Station Program (ISSP) Boards/Panels	Strategic ISS/SSP flight inputs to the Space Shittle Program	4-5 meetings	Monthly
2.2.3.1.09	Represent the Strategic Planning & IntegrationTeam as a technical expert at boards and panels	Technical representative for Strategic Planning & Integration Team 1. RIP 2. FPWG 3. IMT 4. PICB 5. JOP 6. Videoconferences/Telecons 7. SSCB 8. MIOCB 9. Logistics & Maintenance End-to-End 10. SWG 11. VCB 12. AWG 13. TIMs 14. FAWG 15. CTWG	1. 3-4 meetings 2. 1-4 meetings 3. 1 meeting 4. 2-4 meetings 5. 1-3 meetings 6. 8-12 meetings 7. 4 meetings 8. 1-2 meetings 9. 1 meetings 10. 1 meeting 11. 1-2 meetings 12. 4 meetings 13. 2-4 meetings 14. 1 meeting 15. 4 meetings	1. Monthly 2. Monthly 3. Monthly 4. Monthly 5. Quarterly 6. Monthly 7. Annually 8. Monthly 9. Monthly 10. Monthly 11. Monthly 12. Monthly 13. Annually 14. Monthly 15. Monthly
2.2.3.1.10	Provide technical inputs and review assessments for other ISSP documents or reviews.	Technical inputs to ISS documents and reviews. Documents include: IDRDs, GGR&C, SPIP (Volume 2), and Flight Data File Review (FDR). Technical Coordination Meeting and Change Request Evaluations	30 inputs	Monthly
2.2.3.1.11	Develop and Provide strategic studies	Special Studies	1. Two	1. Yearly

		1. Major Strategic Study requiring more that 2 months to asses. 2. Minor Strategic Study requiring less than 1 month and greater than 1 week to asses. 3. Quick Strategic Study requiring one week or less to assess.	2. Twenty-five 3. Thirty-five	2. Yearly 3. Yearly
2.2.3.1.12	Maintain and update SSP 50112 "Operations Summary Document: (OSD) to establish strategis allocaions of resources for operations planning.	Update the Operations Summary Document (SSP 50112)	Once	Yearly
2.2.3.1.13	Perform the Annual Traffic Model Report	ISS strategic resupply / logistics (traffic model) analyses	Once	Yearly
2.2.3.1.14	Develop the Semi-Annual Traffic Model Assumptions Document	ISS strategic resupply/logistics (traffic model) assumptions docuement	Two	Yearly
2.2.3.1.15	Applications and Data Systems	Updates to applications and data systems 1. SPI action item tracking database 2. Traffic modle spreadsheets 3. SPEARMAN 4. CR tracking database 5. SCROALE	Three	Yearly
2.2.3.1.16	Develop Groundrules and Constraints for the ATV, HTV, and 6 Crew Operations related to vehicle traffic, crew time, and crew rotation.	GGR&C updates 1. Visiting Vehicle traffic (ATV and HTV)	Four	Yearly

		2. Crew time 3. Crew rotation 4. 6-Crew		
2.2.3.2	Configuration Analysis, Modeling and Mass Properties (CAMMP)			
2.2.3.2.01	Shall maintain a technical understanding of the on-orbit vehicle assembly flows and the associated on-orbit hardware configuration for flight, intermediate, and stage configurations. The contractor shall also maintain a technical understanding of the assembly and configuration constraints necessary to manage the strategic, tactical, and real-time external Vehicle configuration	Review of maturing configuration data to maintain technical understanding of on-orbit vehicle assembly flows, hardware configuration, and configuration constraints	3 times	Month
2.2.3.2.02	Assess, integrate, and coordinate requirements associated to the ISS external vehicles configuration, that impact the external configuration for flight, intermediate, and/or stage configurations	ISS external vehicle configuration requirements development 1. Review data for maturing hardware 2. Participate in design reviews	1. 2 times 2. 3 reviews	1. Monthly 2. Yearly
2.2.3.2.03	Maintain and update the SSP 50504, ISS Configuration Document and Assembly Matrix	1. SSP 50504 updates 2. Assembly Matrix update for SSP 50504 (to assembly complete) 3. Assembly Matrix update for Blue Book development (covers 18 month Blue Book timeframe)	1. One 2. One 3. Two	1. Yearly 2. Yearly 3. Yearly
2.2.3.2.04	Maintain and coordinate the revision of SSP 30219, ISS Reference Coordinate Systems Document that documents the ISS reference coordinate systems for major elements and robotically handled items	SSP 30129 updates	One	Yearly
2.2.3.2.05	CAD Model Development Support			
2.2.3.2.05.a	Participate in CAD Model User Technical Interchange Meetings	Participate in CAD Model TIMs and provide technical	One TIM	Monthly

	(TIMs) and Measurement Technical Interchange Meetings (TIMs). Provide inputs necessary to get the necessary validated and as-built CAD models	inputs per flight		
2.2.3.2.05.b	Ensure that the external physical configuration data needed by the ISSP/SSP users is provided	Physical configuration data from CAD models is available to ISSP/SSP users	One	Monthly
2.2.3.2.06	Develop and gain concurrence of external configuration protocols with the International Partners and any other affected teams	IP External Configuration protocols	One	Yearly
2.2.3.2.07	Develop and review the mission-specific ISS/SSP On-Orbit Interface Control Document (ICD), Section 3, Physical Configuration for each Shuttle flight.	ISS/SSP On-orbit ICD, Section 3, and Physical Configuration	Initial: One per Shuttle flight Update: Average Four Shuttle flights	Initial: Baselined at Launch - 10 months
2.2.3.2.08	Develop and distribute Vehicle Configuration Joint Working Group (JTWG) mission-specific vehicle configuration data sources letters to the ISSP/SSP community	JTWG mission specific configuration data sources letters	Initial: One per Shuttle flight Update: One per Shuttle flight	Initial: Launch - 9 months Update: Launch - 4 months
2.2.3.2.09	Maintain and utilize the External Configuration Analysis and Tracking Tool (ExCATT) and provide web-based reports accessible by the ISSP	Current and planned external configuration items location tracking and reporting.ExCATT web-based reports 1. COFR report 2. Pre-flight plan 3. Post flight	1. One per ISS flight (Shuttle and visiting vehicles) 2. One update per Shuttle flight 3. One update for each Shuttle flights	1. L-1 month 2. L-1 week 3. Landing + 3 weeks
2.2.3.2.10	Develop revisions of the On-orbit Assembly Modeling and Mass Properties Data Book	Mass Properties Data Book includes the mass and aerodynamic properties for each ISS flight and corresponding intermediate stage configurations for and 18 month span of time.	See DRD	See DRD
2.2.3.2.11	Review ISS Vehicle Sustaining Engineering team Launch - 30 days delivery of pre-flight on-orbit ISSP mass properties prior to every ISS flight docking, undocking and redocking. Coordinate and resolve issues due to mass properties differences between the Launch - 30 days data delivery and the	Reconcile discrepancies as required between ISS vechicle Sustaining Engineering Launch - 30 days mass properties and Blue Book	For each flight as follows:2 Soyuz, 3-4 Progress, and3 Shuttle	Launch - 30 days

	Blue Book			
2.2.3.2.12	Perform ISS configuration, clearance external stowage and mass property analysis using approved 3D CAD models	ISS configuration, clearance external stowage, and mass property analysis to include visiting vehicle docking clearance.	Four	Monthly
2.2.3.2.13	Develop and deliver simplified 3D CAD models to the IP's in .igs and .step formats	Simplified 3D CAD models development and delivery to IP's for non-Russian Segment on-orbit configuration hardware	Four	Yearly
2.2.3.2.14	Provide electronic dimensioned and non-dimensioned hidden line or shaded drawings to support the development of ISS documentation	Dimensioned and non-dimensioned hidden line or shaded drawings	Four	Yearly
2.2.3.2.15	Maintain the CAMMP team website to record and communicate CAMMP activities to the NASA community. Provide launch vehicle ascent and descent weight assessments to support manifest assessments in the strategic timeframe	Update CAMMP team website	Approximately twoce per week	Monthly
2.2.3.2.16	Participate in the OM2 Working Group	Document the CAMMP Program processes.	One	Weekly
2.2.3.2.17	Provide technical inputs and review for ISSP documents or reviews	Change Request (CR) review	Twenty	Monthly
2.2.3.2.18	Provide technical support as needed to Mission Operations Directorate and to the ISSP through assessment of strategic ISSP (including International Partner and Participant) impacts during resolution of significant in-flight anomalies. Such support includes provision of technical assessments that individual specialists within the contractor's employ may be able to provide to the Mission Evaluation Room (MER), workin with the Vehicle Sustaining Engineering team on a temporary basis to resolve mission or life-critical issues.	Anomaly Resolution Support to the MER	For each flight as follows: 2 Soyuz, 3-4 Progress, and 3 Shuttle	Yearly
2.2.3.3	Internal Volume Configuration			

	(IVC)			
2.2.3.3.01	Provide and maintain criteria for evaluating and prioritizing ISS internal volume demands in accordance with SSP 50261-01 (Generic Ground Rules and Constraints), Section 3.12, IVC Constraints & Ground Rules.	Input to SSP 50261-01 to include criteria for evaluation and prioritization of ISS internal volume demands	One	Yearly
2.2.3.3.02	Document and maintain the planned ISS IVA topology in SSP 50564	Updated ISS Interior Volume Configuration topologies 1. Baselined updated in SSP 50564 associated with MIM updates or major interim assembly sequence releases 2. Updates to working version based on latest program plannign data, approved CRs, and hardware changes to support trade studies, hardware development, and IVA systems integration	1. One 2. One	1. Yearly 2. Monthly
2.2.3.3.03	Develop and maintain a unified 3D CAD model of the Station's interior	ISS integrated interior 3D CAD model consisting of all modules, racks, and significant GFE for a particular ISS stage	Two per ISS flight as per DRD	See DRD
2.2.3.3.04	Graphically analyze the acceptability of the ISS planned configurations based on the documented pass/fail criteria	Reports in a predefined format of the graphic analysis of the ISS planned configuration based on evaluation of the ISS interior 3D CAD models, including VAC statement preparation	Two per ISS flight	One at Launch - 9 months One at Launch - 3 months
2.2.3.3.05	Develop major situation unique analyses, as required, to provide inputs to ISSP planning and issue resolution. This shall include developing updated IVA topologies, relevant 3D CAD models, reports on IVA issue resolution, significant integration analysis, major hardware design support, and presentation to ISS	Major and minor situation unique analyses	Ten	Yearly

	Boards and Review Panels.			
2.2.3.3.06	Maintain the IVCWG website to record and communicate IVC activities to the NASA community	Update IVCWG website	Two	Monthly
2.2.3.3.07	Participate in hardware design reviews to ensure identification and resolution of potential issues regarding design features that, if not resolved, would result in GGR&C IVC exceptions.	Identification of potential protrusions into ISS operational envelopes, that would require an exception to the GGR&Cs section 3.12, documented as RIDs in formal design reviews	Two hardware reviews	Yearly
2.2.3.3.08	Participate in the OM2 Working Group	Document the IVC Program processes.	One	Weekly
2.2.3.3.09	Provide technical inputs and review for Payload Protrusion PIRNS and other ISSP documents or reviews.	Technical inputs to ISS documents and reviews. Documents include: IDRDs, Payload Protrusion PIRNs, and hardware ICDs 1. IDRD inputs: Table 4.3 Accommodations Tables and Appendix D Topologies 2. Payload Protrusion PIRN reviews 3. Hardware ICDs and Associated TCMs 4. Change Request (CR) review	1. Three 2. Six 3. Three 4. Monthly	1. Yearly 2. Yearly 3. Yearly 4. Monthly